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THE EFFECTS OF CLOUDY/CLEAR AIR MIXING AND DROPLET pH ON SULFATE AEROSOL FORMATION INACOUPLEDCHEMISTRY/CLIMATE GLOBAL MODEL

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Sulfate aerosols affect global climate by scattering solar radiation and modifying the cloud drop size distribution, which further changes the back-scattering of solar radiation and the cloud life cycle. The negative climate forcing of aerosols counteracts the warming associated with increased greenhouse gases; however, the pattern of forcing is quite different because the distribution of sulfate aerosols is regionally inhomogeneous. Most sulfate aerosols form in the atmosphere through gas phase reactions of DMS, H_2S, and SO_2 with OH or aqueous reaction of $S0_2$ with H_2O_2 and O_3 in cloud drops.

We have coupled our atmospheric chemistry/transport model, GRANTOUR, with the ECHAM3 global climate model which provides several enhanced capabilities in the representation of aerosol interactions. ECHAM includes a specific representation of liquid water in large-scale clouds that allows us to represent the aqueous conversion of SO_2 to sulfate as well as to improve the parameterization of precipitation scavenging. We perform calculations of the gas-phase reactions throughout the atmosphere and calculations of the gas-phase and aqueous reactions inside clouds. To represent the mixing of clear and cloudy air we periodically combine the concentrations of the reacting species based on the large-scale cloud fraction. We will present global simulation results using different mixing periods to investigate the effects of mixing time on sulfate distributions.

The volubility of SO_2 and therefore the rate of aqueous formation of SO_4^{2-} is dependent on the pH of cloud droplets. Since our model does not currently include all the species that determine pH we specify a droplet pH. We will present global simulation results with several different assumed pH's to show the effect of droplet pH on global sulfate distributions.

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